

CITY OF RALEIGH

Streets, Sidewalks, and Driveway Access Handbook



**Department of Transportation
1995 Edition**

Revised May 2002



City Of Raleigh North Carolina

May 1, 2002

On behalf of the City of Raleigh, thank you for using the *Streets, Sidewalk, and Driveway Access Handbook*. The standards contained in this handbook contribute to making Raleigh one of the best places to live by making it a safe and well-designed community. We hope that you will find these standards useful and informative, and we welcome any suggestions you may have for improving these standards for future updates.

The most recent changes to this handbook were made by the Raleigh City Council in April to reflect the City's new *Urban Design Guidelines*. In addition to those amendments, the following changes supercede the standards included in this manual:

Table 4 - Horizontal Curve Design Criteria

While our current design standards allow the use of a 6% superelevation on Secondary Arterials and Major Thoroughfares, future submittals should utilize a 4% superelevation ($R_{\min} = 955$ feet), which is consistent with our criteria for all other classifications of roadway. Where horizontal alignments are constrained by field conditions, the use of 6% superelevation ($R_{\min} = 849$ feet) may be utilized.

Table 7 - Intersection Stopping Sight Distance

This table is now superceded by the standards used for the City's Vision Obstruction Program, as shown below.

Speed Limit (mph)	Minimum Intersection Sight Distance	
	2-3 lanes	4 or more lanes
20	200	250
25	250	315
30	300	375
35	350	440
40	400	500
45	450	565
50	500	625
55	550	688

If you should need any other information or if you have any questions about any of the standards included in this handbook, please give me or any member of my staff a call at (919) 890-3430.

Sincerely,

Jimmie Beckom, PE
Director, City of Raleigh Department of Transportation

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CHAPTER 1: INTRODUCTION

The regulations and standards contained in this manual are intended to provide for adequate and coordinated development with necessary facilities to serve and protect the potential users of the roadway system. They are also intended to save unnecessary expenditures of public funds by providing space for public facilities and by providing initial proper construction of *streets, sidewalks* and *driveway access points*. Standards are intended to keep operating costs on public facilities at a reasonable level by obtaining proper alignments and structural sections.

It is recognized that certain improvements financed wholly or in part with State and federal funds are subject to the regulations and standards prescribed by those agencies. Such regulations and standards may be different than those of the *City* and may take priority over City regulations and standards presented in this manual.

In the case where any requirement in the *City Code* conflicts with any regulation or standard presented in this manual, the *City Code* shall control.

The *Transportation Director*, in consultation with other City departments and state agencies, may allow modifications to the design criteria set forth in Chapter 4 of this manual. Modifications may be necessary to allow private or public construction to be compatible with in-place improvements or for unusual and unnecessary circumstances. Modifications to design criteria may be allowed provided that an investigation by the Transportation Director concludes that all of the following criteria can be satisfied.

- 1) The modification to the design criteria is based on sound engineering principles and practices.
- 2) The modification to the design criteria will not create an unsafe or hazardous situation to occur.
- 3) The modification to the design criteria will be equivalent to the minimum criteria set forth herein in terms of efficiency, functionality, durability, structural integrity and long term maintenance.
- 4) The modification to the design criteria will not adversely impact adjacent properties or individual property owners, provided that safety is not compromised.

The *Transportation Director* is authorized to require studies or other pertinent information to be provided by the petitioner to help support or validate the modification request.

Regarding the language which defines the standards in this manual, the word “shall” is to be interpreted as being mandatory. The word “should” is to be interpreted as being the recommendation of the City and, where indicated, denotes a factor or principle to be considered by the developer.

REVISIONS

This manual was adopted by the Raleigh City Council on November 8, 1995. The following changes to this manual have also been adopted by the City Council:

DATE	CHANGE
11/21/95	Section 3.2 – Amended to include exemptions from minimum paving construction requirements (<i>Resolution 971 – 1995</i>)
6/3/97	Section 3.1 – Amended to describe powers of Transportation Director to adjust right-of-way requirements Section 3.2 – Amended to describe powers of Transportation Director to allow variances for dead-end streets Section 3.4 – Amended to require sidewalk connections within private developments (<i>Resolution 458 – 1997</i>)
7/7/98	Figure 7 – Amended to include cul-de-sac dimensions for residential private streets Table 4 – Amended to differentiate horizontal standards for private streets (<i>Resolution 853 – 1998</i>)
4/16/02	Section 4.13 – Added to conform to adopted Urban Design Guidelines Figure 14 – Added to conform to adopted Urban Design Guidelines (<i>Resolution 376 - 2002</i>)

CHAPTER 2: ROADWAY SYSTEMS

In varying degrees, roads serve two basic purposes: (1) moving traffic through an area (thoroughfare function) and (2) providing vehicular access to abutting property (land service function). Unfortunately, these two functions are inherently incompatible. In other words, design elements that improve one function negatively impact the other function. For this reason, it is useful to functionally classify the roadway system into several groups; thus allowing development regulations to be targeted to each type of roadway.

The three roadway system categories utilized in this manual are: the thoroughfare system, the collector street system and the local access system.

2.1 THOROUGHFARE SYSTEM

The thoroughfare system is comprised of principal arterials, secondary arterials, major thoroughfares, minor thoroughfares and sensitive area thoroughfares. All thoroughfare system roadways are illustrated in the *Comprehensive Plan* and/or the *Capital Area Thoroughfare Plan*.

Principal arterials are the most important thoroughfares, comprised of limited-access freeways, expressways, as well as major non-access controlled highways (also referred to as gateway arterials). Principal arterials are also sometimes referred to as major access corridors which are usually designated as federal highways or interstates. These highways are designed to move large volumes of through traffic from one urban region to another and often have state-wide continuity. It is desirable for principal arterials to have grade separated interchanges and a minimal number of traffic signals and driveways along the highway.

The following roadways are designated as principal arterials or major access corridors:

- Interstate 40**
- Interstate 440**
- Interstate 540 / Northern Wake Expressway**
- US 1**
- US 64**
- US 64 Bypass**
- US 70**
- US 401**
- Wade Avenue (I-40 to I-440 Beltline)**

Secondary arterials are also regionally important highways that are generally designated as North Carolina primary and secondary routes. They generally have region-wide continuity. Maintaining high levels of travel service is considered the most important function of the roadway, while maintaining limited degrees of access is considered a secondary function. Secondary arterials are usually multi-lane roadways where access is provided by at-grade intersections and driveways.

Non-arterial major thoroughfares are roadways with considerable city-wide continuity. These roadways are designed to accommodate large volumes of traffic from one area of the city to another. Major thoroughfares are usually multi-lane roadways and direct street and driveway access is allowed.

Minor thoroughfares are roadways leading to or connecting to arterials and major thoroughfares and are designed to accommodate large volumes of traffic but not of major thoroughfare importance. Minor thoroughfares are multi-lane roadways in most instances and direct street and driveway access is allowed.

Sensitive area thoroughfares are major or minor thoroughfares designed with a shoulder and swale section. These roadways are located within Reservoir Watershed Protection Overlay Districts or other areas approved by the *City Council*.

2.2 COLLECTOR STREET SYSTEM

The collector street system provides both land access service and traffic circulation within residential neighborhoods and commercial / industrial areas. It differs from the thoroughfare system in that roadways designated on the collector street system may penetrate neighborhoods, distributing trips from thoroughfare system roadways through the area to their ultimate destinations. Conversely, the collector street system also collects traffic from local streets and channels traffic to the higher systems of streets and highways.

The collector street system consists of collector streets, residential collector streets and in certain instances, commercial streets. Definitions of these street types are provided below. Where development meets the thresholds described in the definitions, a collector, residential collector or commercial street are required, (unless a thoroughfare system roadway is required). All collector street system roadways are illustrated in the Comprehensive Plan.

Collector streets collect traffic from more than three hundred fifty (350) dwelling units; or collects traffic from schools; libraries; art galleries; or other residential institutions with similar vehicle trip generation characteristics of more than three hundred fifty (350) dwelling units. Collector streets have continuity of more than one-half (1/2) mile in length; or may provide a connection between thoroughfare system roadways; or they provide a connection between major traffic generators which would encourage through traffic on any street not classified as a thoroughfare system roadway.

Residential collector streets collect traffic from more than one hundred fifty (150) dwelling units but less than three hundred fifty one (351) dwelling units; or collects traffic from schools; public museums; libraries; art galleries; or other residential institutions which may generate traffic equivalent to less than three hundred fifty-one (351) dwelling units; or day care facilities of more than seventy (70) enrollees. Residential collector streets have continuity of more than one-half (1/2) mile in length; or may provide a connection between thoroughfare system roadways; or they provide a connection between major traffic generators which would encourage through traffic on any street not classified as a thoroughfare system roadway.

Commercial streets serve as access for predominantly abutting commercial, industrial or other nonresidential properties. A commercial street can be considered a collector street if the roadway is illustrated in the Comprehensive Plan.

2.3 LOCAL ACCESS SYSTEM

The local access system consists of roadways not in one of the higher order systems. This system's primary function is to provide direct driveway access to abutting lands and connect to the collector street system or thoroughfare system. It offers the lowest level of mobility compared to the higher order systems of roadways.

The local access system generally consists of commercial streets, marginal access streets, residential streets and minor residential streets. Definitions of these street types are provided below. Where development meets the thresholds described in the definitions, a commercial street, marginal access street, residential street, or minor residential street are required, (unless a higher system of roadway is required).

Commercial streets serve as access for predominantly abutting commercial, industrial or other nonresidential properties.

Marginal access streets are generally located alongside a thoroughfare system roadway so as to relieve the thoroughfare system roadway of the necessity of providing direct driveway access to abutting properties.

Residential streets may not collect traffic from more than one hundred and fifty (150) dwelling units; schools; museums; libraries; art galleries; day care facilities with more than seventy (70) enrollees; or other uses which may generate traffic volumes or peak loading characteristics equivalent to more than one hundred and fifty (150) dwelling units. Residential streets may not be more than one-half (1/2) mile in length; nor provide a connection between thoroughfare system roadways; nor provide a connection between major traffic generators which would encourage through traffic movements.

Minor residential streets may not collect traffic from more than forty (40) dwelling units. Minor residential streets may not be more than one-half (1/2) mile in length; nor provide a connection between thoroughfare system roadways; nor provide a connection between major traffic generators which would encourage through traffic movements.

2.4 DEFINING ROADWAY THRESHOLDS

To determine the thresholds or the number of dwelling units a local access system or collector street system roadway will collect or serve, the following criteria shall be used:

- 1) Dwelling units with direct driveway access to the street shall be counted as being served by the street.
- 2) Other dwelling units which do not have direct driveway access to the street, but are likely to use the street to obtain access to the collector street system or thoroughfare system, shall be counted as being served by the street.

CHAPTER 3: REGULATIONS

3.1 PUBLIC STREET RIGHT-OF-WAY CONVEYANCE

Whenever a tract of land included within any proposed development plan embraces any part of a thoroughfare system or collector street system roadway and so designated in the Comprehensive Plan or the Capital Area Thoroughfare Plan, after such part of it has been adopted by the proper authority, such part of such proposed public way shall be platted and dedicated in the location and width indicated on the plans. However, no development shall be required to plat more than one hundred ten (110) feet of *right-of-way*, plus *slope easements* as needed except in any of the following instances:

- 1) Freeways/expressways - the minimum right-of-way width required to serve a development. (To determine the minimum required right-of-way for streets by type and intensity, see definitions of minor residential, residential, residential collector, collector and commercial street in Chapter 2).
- 2) Secondary arterials or gateway arterials which contain a median as shown on the Comprehensive Plan and which appear on the City Capital Improvement Program (CIP) or the Transportation Improvement Program (TIP) of the North Carolina Department of Transportation (NCDOT) - the minimum right-of-way width specified on design plans which have been approved by the City Council, but no greater than one hundred thirty (130) feet, plus slope easements as needed.
- 3) Right-of-way width required for additional pavement surfaces to accommodate turning movements, as described in Section 3.2.

In accordance with provisions outlined in the City Code, right-of-way dedications may be eligible for monetary reimbursement.

Developments which embrace only one side of an existing or planned roadway right-of-way will only be required to plat and dedicate additional right-of-way for that portion of roadway with which the development has frontage. Such improvements shall be in conformance with City standards and shall be measured from the *right-of-way center line*.

Right-of-Way Widths

All public roadways, exclusive of slope easements, shall be platted and dedicated in conformance with the schedule of public street right-of-way widths shown in Table 1.

**Table 1. Schedule of Public Street
Right-of-way Widths**

Street Classification	Minimum Right-of-Way Width (feet)
Thoroughfare System	
Principal Arterial	Variable ¹
Secondary Arterial	
with median	130
without median	110
Major Thoroughfare	90
Minor Thoroughfare	80
Sensitive Area Thoroughfare	
Major Thoroughfare	100
Minor Thoroughfare	70
Collector Street System	
Collector Street	60
Residential Collector Street	55
Local Access System	
Commercial Street	60
Marginal Access Street	50
Residential Street	50
Minor Residential Street	45 ²

Notes:

1. The minimum required right-of-way width to serve the development shall be platted. To determine the minimum required right-of-way width to serve the development, see definitions of minor residential, residential, residential collector, collector, and commercial streets in Chapter 2.
2. The right-of-way width may be reduced to forty (40) feet for minor residential streets where no sidewalk is to be provided.

Coordination With Adopted Roadway Plans

It is the responsibility of the developer to take future roadway plans of the City and NCDOT into account when laying out a development plan.

Reservation Periods for Right-of-Way

For thoroughfare system roadways where the planned right-of-way width is greater than that which can be required, (as specified in the preceding paragraphs), the developer shall be required to reserve the extra right-of-way width for a period not to exceed twelve (12) months from the date of approval of the development plan.

Slope Easements

A slope easement of twenty (20) feet in width shall be required adjoining each side of a street right-of-way. The City may reduce or increase the slope easement width if due to terrain.

If a property owner submits to the City sufficient information to show that improvements to be located in the slope easement do not interfere with the right of the public to construct within the adjoining right-of-way; streets, sidewalks, or both, then the City shall allow the proposed improvement.

Adjustments to Required Right-of-Way Widths

The Transportation Director may reduce the required minimum right-of-way width shown in Table 1 due to the location of an existing building or use in the proposed new right-of-way, upon finding that the reduced right-of-way shall be able to accommodate the planned future street cross section.

3.2 ROADWAY CONSTRUCTION THROUGH AND ADJOINING DEVELOPMENTS

All public roadways inside the Corporate limits of the City shall be constructed in conformance with *City standards and specifications*; however, if the roadway is maintained by NCDOT, then the roadway shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.

All public roadways that are outside the Corporate limits of the City and when water or sewer is connected to the City utility system or made available within one (1) year after approval of a development plan, shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.

Roadways that are outside the Corporate limits of the City and where neither City water nor sewer are available or made available within one (1) year after approval of a development plan, shall be constructed in conformance with NCDOT standards and specifications.

Roadways that are within a Reservoir Watershed Protection Area Overlay District or classified as a sensitive area thoroughfare, shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.

The minimum design cross-section for roadways constructed to City standards are illustrated in Section 4.1. Consult NCDOT for minimum design cross-sections for roadways that require their approval.

Minimum Paving Construction

The developer shall be responsible for the cost and installation of the applicable standard minor residential, residential, residential collector, collector, or commercial street width and pavement design requirements. Paving shall be installed for roadways through and adjoining the development in accordance with City standards and specifications (or NCDOT standards, if applicable). The developer shall also provide additional pavement surfaces for turning movements to serve the development and make thoroughfare improvements in accordance with this section.

In special circumstances, the City may elect to require payment of a fee-in-lieu of installation to the applicable minimum paving construction standards as outlined in this section. Criteria for requiring fee-in-lieu payments are specified in the City's standard procedure for "Fee-in-lieu of Determination and Administration" (S.P. 100-29).

Exceptions To Paving Construction

Streets with curb and gutter, other than thoroughfare system roadways, which were built pursuant to earlier City paving standards, do not have to be widened unless such widening is needed to alleviate safety problems or increased traffic congestion. But sidewalks and curb and gutter improvements required in Sections 3.3 and 3.4 respectively shall not be exempted by this provision.

Developments will not be responsible for minimum paving construction requirements along existing or planned roadways, if any of the following conditions exist:

- 1) Exemptions shall be provided for existing single-family lots and single-family subdivisions which have all lots fronting on existing streets, except when construction is needed to extend adjacent street and sidewalk facilities.
- 2) Exemptions shall be provided for frontage on roadways that are exempt from curb and gutter requirements or streets which have been improved under the resurfacing assessment program.
- 3) Exemptions shall be provided for frontage along future thoroughfares when construction as part of the development is not required in the plan approval process.
- 4) Exemptions shall be provided for frontage along streets approved for construction funding in the State Transportation Improvement Program or other State funding programs.
- 5) Exemptions shall be provided for frontage along streets approved for construction funding in the City's Capital Improvement Program and for which right-of-way acquisition has been initiated. The City's normal street improvement assessment policies will be applicable in these cases.
- 6) Exemptions shall be provided for frontage along existing or planned future roadways having full control of access (i.e., no direct access from the property to the roadway is permitted) will not be responsible for the cost and installation of minimum paving construction requirements for controlled access roadways.

Additional Pavement Surfaces To Accommodate Turning Movements

An additional lane or lanes of pavement and appropriate pavement tapers shall be required and constructed at intersections to the standards specified in Section 4.9 under the following conditions:

(1) LEFT-TURN LANE -- SIGNALIZED INTERSECTIONS

- (a.) Where fully protected left-turn phasing is provided; or,
- (b.) Where peak-hour left-turn volume exceeds 100 vph; or,
- (c.) Where delay caused by left-turning vehicles blocking through vehicles would reduce the operating capacity of the intersection below level of service 'D' (LOS D), as defined in the "Highway Capacity Manual, 1994."

(2) RIGHT-TURN LANE -- SIGNALIZED INTERSECTIONS

An exclusive right-turn lane shall be provided where the right-turning volume exceeds 300 vph and the adjacent through lane volume also exceed 300 vph per lane. When calculating the adjacent through lane volume, it should be assumed that all through lanes have equal volumes.

(3) LEFT-TURN LANE -- UNSIGNALIZED INTERSECTIONS

A separate left-turn lane shall be provided on a two-lane roadway, depending on the percent of left-turning vehicles in the advancing volume against the opposing volume. Table 2 indicates when a separate left-turn lane should be provided on a two-lane roadway.

For four-lane roadways or greater in width, a separate left turn lane should be provided when delay caused by the left-turning vehicles blocking through vehicles, would reduce operating capacity of the intersection below level of service 'D', as defined in the "Highway Capacity Manual, 1994."

(4) RIGHT-TURN / DECELERATION LANE -- UNSIGNALIZED INTERSECTIONS

A separate right-turn / deceleration lane shall be provided depending on the roadway's single lane volume, the volume of right-turning vehicles, and the posted speed of the roadway. Figure 1 indicates when a separate right-turn lane shall be provided.

(5) ADDITIONAL TURNING LANES

The City may require additional turning lanes and tapers or other improvements when it believes that the absence of such improvement will create an unsafe condition or would reduce the operating capacity of the intersection below level of service 'D', as defined in the "Highway Capacity Manual, 1994."

Table 2. Left Turn Lane Warrants
for Two-Lane Roadways

OPPOSING VOLUME (veh./hr.)	ADVANCING VOLUME (veh./hr.)			
	5% Left Turns	10% Left Turns	20% Left Turns	30% Left Turns
40-mph Operating Speed				
800	330	240	180	160
600	410	305	225	200
400	510	380	275	245
200	640	470	350	305
100	720	515	390	340
50-mph Operating Speed				
800	280	210	165	135
600	350	260	195	170
400	430	320	240	210
200	550	400	300	270
100	615	445	335	295
60-mph Operating Speed				
800	230	170	125	115
600	290	210	160	140
400	365	270	200	175
200	450	330	250	215
100	505	370	275	240

Note: For operating speeds not shown, interpret between given values.

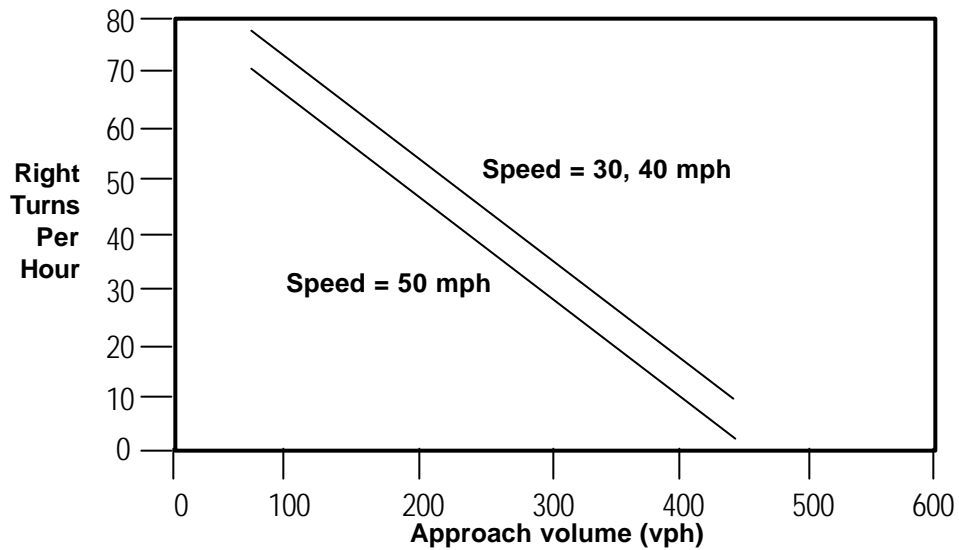


Figure 1. Right-turn / Deceleration Lane Warrants

Thoroughfare Improvements

Complete thoroughfare improvements, in conformance with the minimum roadway design cross-sections illustrated in Section 4.1, shall be made by developments along the entire length of a thoroughfare system roadway, if any of the following three conditions exist:

- 1) A development is located within 400 feet of an existing or proposed intersection of either two (2) thoroughfare system roadways or a thoroughfare system roadway and a collector street system roadway, and the improvement can be utilized by motorists as a travel lane or turning lane to improve vehicle delay, congestion or safety.
- 2) The predicted vehicle trips generated by a development during peak travel periods, combined with the background traffic volume traveling on the thoroughfare system roadway(s), would reduce the roadway or nearby intersections' capacity below Level-Of-Service 'D', as defined in the *Highway Capacity Manual, 1994*, and the improvement can be utilized by motorists as a travel lane or turning lane to improve vehicle delay, congestion or safety.
- 3) The improvement would be an extension of an already existing widened section of roadway, and the improvement can be utilized by motorists as a travel lane or turning lane to improve vehicle delay, congestion or safety.

Partial thoroughfare improvements, in conformance with the minimum paving construction standards and additional pavement surfaces to accommodate turning movements will be required in the event complete thoroughfare improvements are not required as conditioned in the preceding paragraph.

Dead-End Streets

Dead-end streets should be limited in use, serving residential and non-residential land uses that are expected to generate low traffic volumes. Unless an equally safe and convenient form of turning space is provided, dead-end streets shall terminate in a circular cul-de-sac. Dead-end streets shall conform to the design cross-sections shown in Section 4.2.

The maximum dead-end street length serving residential dwelling units shall not exceed eight hundred (800) linear feet. The maximum dead-end street length serving non-residential uses shall not exceed four hundred (400) linear feet. The dead-end street length is measured from the center line of the intersecting street to the center of the circular cul-de-sac right-of-way. In cases where there is no cul-de-sac, the length shall be measured to the farthest point along the dead-end street from the intersecting street.

The Transportation Director may approve extra-long dead-end streets of up to 10% above the 800-foot (residential) and 400-foot (nonresidential) standards if a finding is made that there is no practical through extension possible due to severe topography or other physical features, or due to existing surrounding development.

3.3 CURB & GUTTER

All public roadways inside the Corporate limits of the City and outside the City when water or sewer is connected to the City utility system, shall be constructed with curbs and gutters.

Curbs and gutters shall be a combination curb and gutter or such other construction approved by the City. Rolled or valley-type curbs are permitted for new collector, residential collector, residential or minor residential streets if all the following are met:

- 1) Where any existing street containing a standard curb and gutter is to be extended, the curb and gutter shall be extended to at least the next intersection.
- 2) Curb treatments shall be the same on both sides of a street, but a different treatment may be used adjoining a median.
- 3) At the interface of differing curb or shoulder treatments, drainage structures are to be installed to assure uninterrupted flow of storm water between the two drainage systems.

Curb and gutter will not be required on the following streets:

- 1) Sensitive area thoroughfares or roadways located within a Reservoir Watershed Protection Area Overlay District. Curb and gutter may be required where right-of-way is restricted or where needed to control stormwater erosion and sedimentation.
- 2) Roadways other than thoroughfare system roadways that were inside the City limits and paved prior to 1950.
- 3) Where curb and gutter is not planned to be installed in the future as part of design plans on street improvements, or where none is required as part of a City Council approved Neighborhood Plan.

3.4 SIDEWALK

All public roadways inside the Corporate limits of the City and outside the City when water or sewer is connected to the City utility system, shall be constructed with sidewalk. See Table 3 for sidewalk location requirements on City standard streets.

Table 3. Sidewalk Location Requirements

Roadway Classification	Sidewalk Located on	
	One Side	Both Sides
Thoroughfare System		
Principal Arterials		X
Secondary Arterials		X
Major Thoroughfares		X
Minor Thoroughfares		X
Collector Street System		
Collector Street	X	
Residential Collector Street	X	
Local Access System		
Commercial Street	X	
Marginal Access Street	X	
Residential Street	X	
Minor Residential Street	X	

The sidewalk location may be altered from the standards shown in Section 4.1 if an obstruction exists and the modified location will not pose any safety problems. Additional right-of-way or easements may be required if sidewalk is located outside the existing right-of-way.

Sidewalks shall be provided along the block face of a commercial street that adjoins any shopping center or shopping area, school, stadium or coliseum or arena of over two hundred fifty (250) seats.

Sidewalks meeting the standard of §10-7001 or as approved by the Planning Commission shall be required in areas served by private streets. Sidewalks shall provide general pedestrian access within the development served and shall connect with public sidewalks, public streets, and greenway access points. Each block, or each building in the case of group housing, shall be served by a connection to the pedestrian access system.

Sidewalk shall not be required on the following roadways:

- 1) Minor residential streets serving no more than ten (10) dwelling units. Corner lots which have frontage on both a connective or loop street shall not be included in determining the number of dwelling units served by the street.
- 2) Commercial dead-end streets which are less than one hundred fifty (150) feet in length.

- 3) Sensitive area thoroughfares or roadways located within a Reservoir Watershed Protection Area Overlay District; unless the development is connected to City water or sewer and is located within one-half mile of a school, shopping center or shopping area, or a connection to a greenway or public park, in which case a sidewalk shall be constructed to standards compatible with a non-curb and gutter street section.

3.5 SIDEWALK ACCESS RAMPS

Sidewalk access ramps, also commonly referred to as wheelchair ramps for the physically handicapped, shall be provided at all intersections where curb and gutter are provided and where sidewalks and/or greenway trails intersect any street.

3.6 ROADWAY LAYOUT

The roadway layout of any development should be in conformity with a plan for the most advantageous development of the entire community. Public streets shall be constructed to the boundary lines of the development submitted for approval when required to provide for efficient circulation of traffic within the community.

Each side of a commercial street located within a Community or Neighborhood Focus Area as designated by the Comprehensive Plan, or a collector, residential or minor residential street shall be intersected by at least one connective street within every fifteen hundred (1,500) -foot length of the street. The fifteen hundred-foot length shall be measured from the origination point, if established, of the collector, commercial, residential or minor residential street. If an intersection is located to interrupt a dominant traffic flow along two (2) or more streets, then both streets are included in the calculation of the fifteen hundred-foot length.

A development may be approved which contains a street(s) which does not meet the above layout or creates a violation of this layout if:

- 1) Existing surrounding development prevents extending a street to any adjoining developments to meet this regulation; or,
- 2) The adjoining existing street pattern or a planned "stub" street provides for an appropriate intersecting street beyond the fifteen hundred-foot point, that would provide equivalent benefits as an intersecting street within fifteen hundred (1,500) feet; or,
- 3) Severe topography or other physical features warrant making a connection of an intersecting street at another location either inside or outside the development to provide equivalent benefits as an intersecting street within a distance of fifteen hundred (1,500) feet, and this other alternate specific location is provided for at the time the development making the request for an alternate location is approved.

Where a proposed development embraces a thoroughfare system roadway, it should be planned so that lots fronting on the roadway gain their access from collector system roadways or local access system streets.

Existing adjoining public streets, public platted streets, and publicly planned streets shall be continued and extended as public streets as part of the development. Streets that are not to be extended shall be terminated in a cul-de-sac in conformance with Section 4.2 of this manual.

Wherever there exists a dedicated or platted half street adjacent to the tract to be developed, the other half shall be platted and constructed.

Where a proposed development will extend a public street that is already stubbed out to the property line, such extension shall be a public street.

Where a through street or a series of streets establishes a connection between two (2) public streets and such connection is greater than twelve hundred (1,200) feet in length or such connection may encourage through traffic not generated by the development, such street shall be a public street, except in instances where the approving authority determines that requiring such connection to be a public street will serve no purpose due to the existing or proposed street pattern, traffic flow or traffic volumes.

Where a proposed development utilizing private streets has an area of twenty (20) or more acres, at least one public through street must be provided in a location determined by the City to assure continuity of the public street system, except in instances where the approving authority determines that such public through street will serve no purpose due to the existing or proposed street pattern, traffic flow or traffic volume. The City may also require additional public through streets for the provision of emergency services such as police and fire protection, or to provide alternate circulation at congested or critical intersections.

Generally, streets should not be allowed in any conservation buffer district or a protective yard. A street in a conservation management district or a protective yard will be permitted when it is determined by the approving authority that a street will not be injurious to the public welfare and a street is necessary for traffic circulation of the entire neighboring area, provided further, that the street is located to minimize the disruption or destruction of the conservation management district or a protective yard.

3.7 PRIVATE STREETS

Private streets will be permitted in townhouse, condominium, group housing and cluster unit developments; however, private streets can not be used by single family residential or duplex dwellings. The maintenance responsibility of the streets and sidewalks shall rest with the property owner or the homeowners' association. All private streets shall conform to the minimum design standards set forth in Section 4.11.

3.8 RESIDENTIAL DRIVEWAY ACCESS

Residential driveway access to and from streets shall be constructed in accordance with City standards as outlined below:

Driveway Type

The standard residential driveway access for the City shall be the "ramp" type driveway section. Ramp type driveways shall be constructed in accordance with City standards and specifications as outlined in the City Code.

Width of Driveway

The width of a residential driveway shall be no less than ten (10) feet and no more than twenty-four (24) feet. When two (2) residential driveways coincide along a property line, the maximum width shall not exceed twenty-four (24) feet.

Number of Driveway Access Points

The number of residential driveway access points servicing any lawful lot should be limited to one (1); however, in no instance shall there be more than two (2) residential driveway access points servicing the lot. Residential driveway access points shall also conform to the guidelines for driveway access points along thoroughfare system roadways as presented in Section 4.12.

Location of Driveway Access Points

Residential driveways shall be spaced at least twenty (20) feet from any other driveway on the same lot nor nearer than three and one-half (3.5) feet to any lot line, except where two (2) residential driveways coincide along the same lot line.

The minimum *corner clearance* from the curb line or edge of pavement of intersecting streets shall be at least twenty (20) feet from the point of tangency of the radius curvature, or twenty (20) feet from the intersection of right-of-way lines, whichever is greater. The radius of the driveway shall not encroach on the minimum corner clearance.

Alignment and Grades

Residential driveway access alignment and grades shall comply with the standards and specifications outlined in the City Code.

Sight Distance

Adequate sight distance should be provided at all driveway access points and shall be in accordance with the standards provided in the manual, "Policy on Street and Driveway Access to North Carolina Highways," as adopted and amended by NCDOT.

3.9 COMMERCIAL DRIVEWAY ACCESS

Commercial driveway access to and from streets shall be constructed in accordance with the standards and specifications provided in the manual, "Policy on Street and Driveway Access to North Carolina Highways," as adopted and amended by NCDOT. Developments should also comply with the provisions described in Section 4.12 of this manual.

For any development, the number of driveway access points may be restricted where it is necessary for purposes of decreasing traffic congestion or hazards. These restrictions may include required common access points. The City Attorney's office shall approve the recordable documents for all required common access points.

CHAPTER 4: DESIGN CRITERIA

The design criteria presented in this chapter apply to all roadways that are required to be designed and constructed to City standards and specifications. The design criteria presented below should be used as minimum requirements for new developments and may be increased at the direction of the City if warranted by safety hazards or traffic operations.

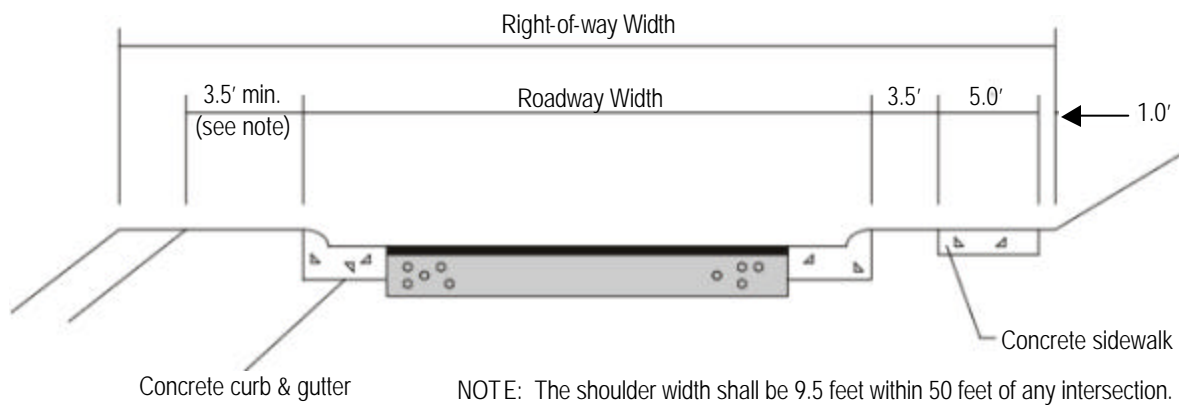
The Transportation Director, in consultation with other City departments and State agencies, may allow modifications to the design criteria set forth in this chapter. Modifications may be necessary to allow private or public construction to be compatible with in-place improvements or for unusual and unnecessary circumstances. Modifications to design criteria may be allowed provided that an investigation by the Transportation Director concludes that all of the following criteria can be satisfied.

- 1) The modification to the design criteria is based on sound engineering principles and practices.
- 2) The modification to the design criteria will not create an unsafe or hazardous situation to occur.
- 3) The modification to the design criteria will be equivalent to the minimum criteria set forth herein in terms of functionality, efficiency, durability, structural integrity and long term maintenance.
- 4) The modification to the design criteria will not adversely impact adjacent properties or individual property owners, provided that safety is not compromised.

The Transportation Director is authorized to require studies or other pertinent information to be provided by the petitioner to help support or validate the modification request.

4.1 ROADWAY DESIGN CROSS-SECTIONS

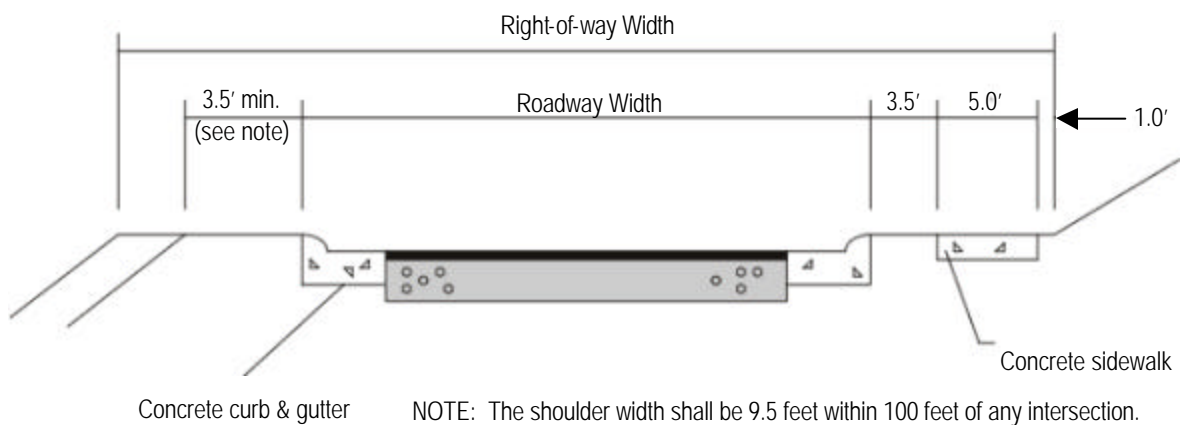
Minimum dimensions for public roadways constructed to City standards are illustrated in Figures 2 through 6.



Roadway Classification	Right-of-way Width (feet)	Roadway Width (feet)
Minor Residential Street	45*	26
Residential Street	50	31
Marginal Access Street	50	31
Commercial Street	60	41

* The right-of-way width may be reduced to 40 feet if sidewalk is not required.

Figure 2. Local Access System Roadways

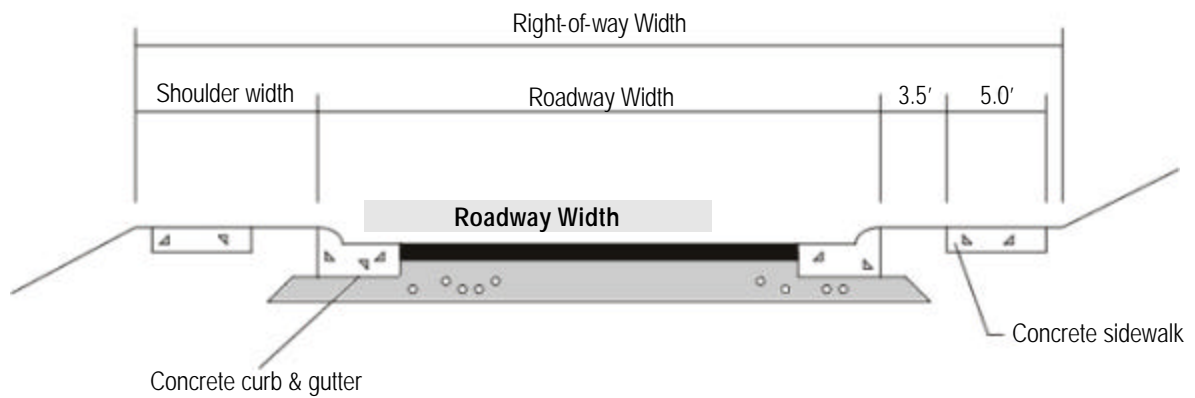


Roadway Classification	Right-of-way Width (feet)	Roadway Width (feet)
Residential Collector Street	55*	36**
Collector Street	60	41

*60 feet within 300' of a collector street or a thoroughfare system roadway intersection

**41 feet within 300' of a collector street or a thoroughfare system roadway intersection

Figure 3. Collector Street System Roadways



Roadway Classification	Right-of-way Width (feet)	Roadway Width (feet)	Shoulder Width (feet)
Minor Thoroughfare	80	53	13.5
Major Thoroughfare	90	65	12.5
Secondary Arterial	110	89	10.5
Principal Arterial	See Figure 6 for dimensions		

Figure 4. Thoroughfare System Roadways

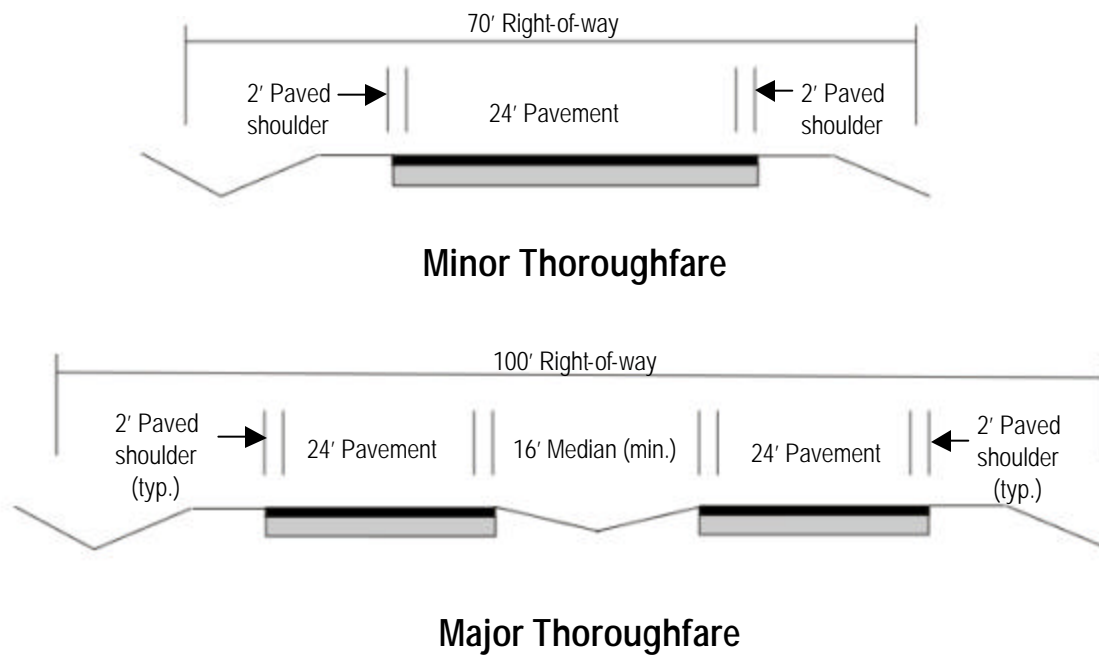
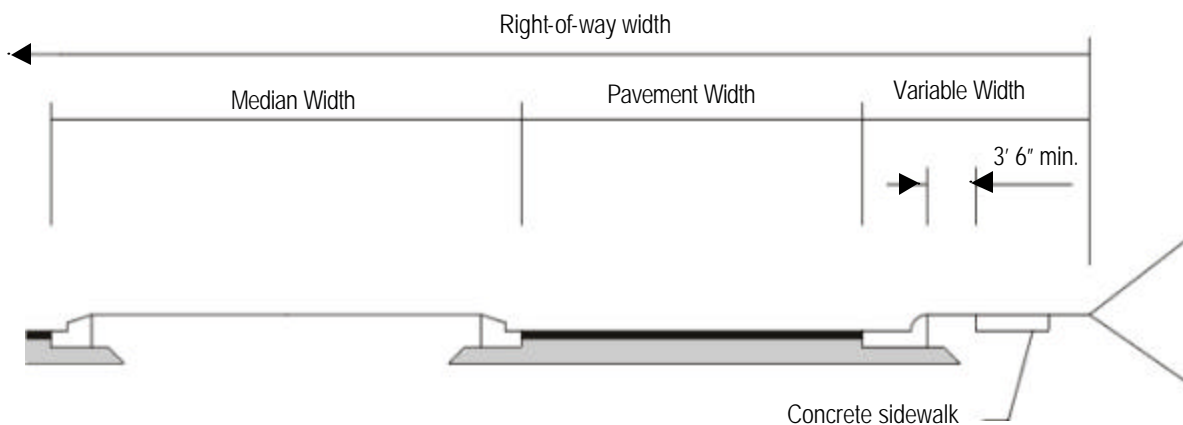


Figure 5. Sensitive Area Thoroughfares



Roadway Classification	Right-of-way Width (feet)	Median Width (feet)	Pavement Width (feet)
Residential Collector Street	80	16	20
Collector Street	80	16	20
Commercial Street	80	16	20
Minor Thoroughfare	90	16	24
Major Thoroughfare	90	16	24
Secondary Arterial	130	30	36
Principal Arterial	130-300	0-46	48

Note: For other roadways not shown, the minimum pavement width in each direction of travel shall be 20 feet.

Figure 6. Median Divided Roadways

4.2 DEAD-END STREET DESIGN

Minimum dimensions for circular cul-de-sac streets are shown in Figure 7. Alternative turn-around designs on residential streets serving six (6) dwelling units or less may be considered on a case by case basis. Alternative designs must readily accommodate emergency vehicles and sanitation trucks.

Medians may be permitted where the cul-de-sac radius is increased and it can be demonstrated that emergency vehicles and sanitation trucks can be accommodated. Landscaped medians will not be maintained by the City and a private maintenance agreement for the median shall be required to be approved by the City Attorney.

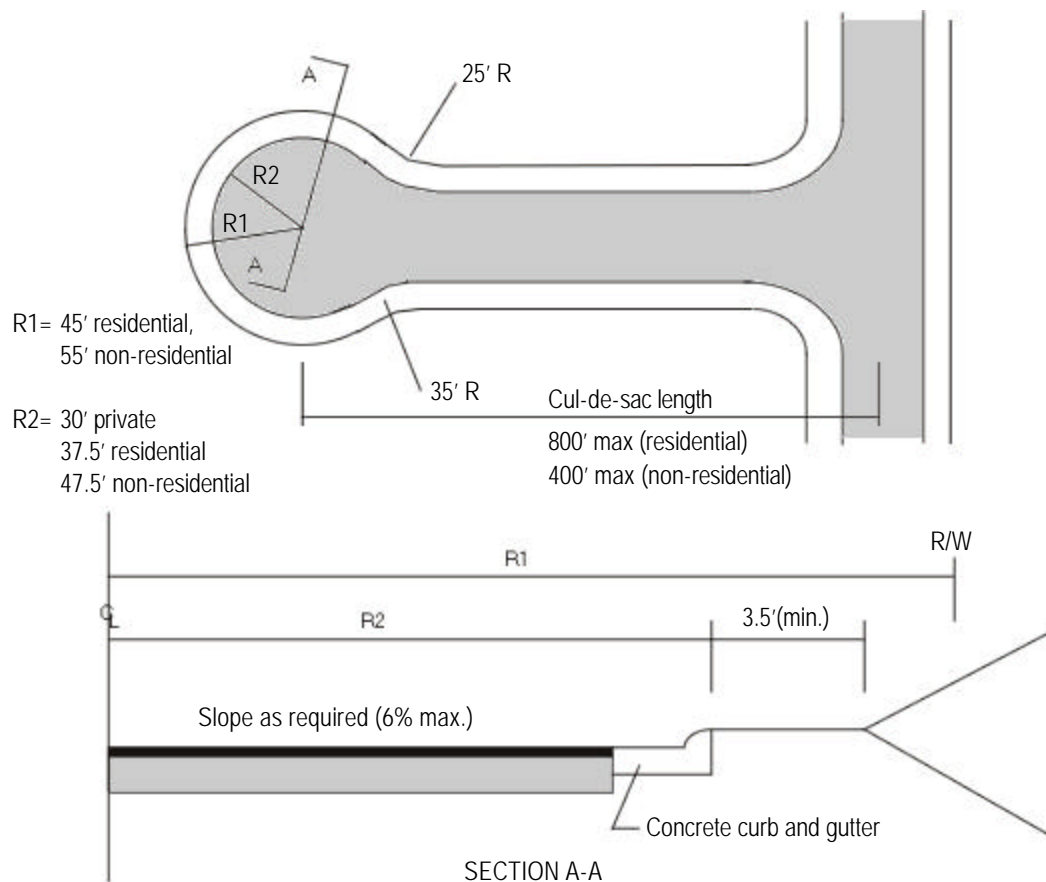


Figure 7. Dead-End Street Dimensions

4.3 HORIZONTAL STREET DESIGN

Design criteria for design speed, centerline radius, reverse curve tangent distance and maximum superelevation rates for streets are summarized in Table 4. Superelevation rates, minimum runoff lengths and methods of distribution should be in accordance with *AASHTO* guidelines.

The minimum tangent length of an approaching intersection should be fifty (50) feet for local access system streets. All higher system streets shall have a tangent section no less than one hundred (100) feet approaching the intersection. Tangent lengths shall be measured from the intersection of the two rights-of-way.

4.4 VERTICAL STREET DESIGN

Wherever practical, streets should follow the existing contours of a site so as to avoid excessive grading and removal of existing vegetation. Street grades shall not be less than three-quarters of one percent (0.75%). Standards for vertical street design are listed in Table 5.

At signalized intersections, the maximum grade approaching the intersection should not exceed two (2) percent and extend a minimum distance of two hundred (200) feet in each direction measured from the outside edge of travel way of the intersecting street. For intersections not controlled by a traffic signal, the maximum grade approaching the intersection should not exceed five (5) percent and extend a minimum distance of 100 feet in each direction.

Table 4. Horizontal Curve Design Criteria

Street Classification	Design Speed (mph)	Minimum Centerline Radius (feet)	Maximum Rate of Superelevation for Minimum Centerline Radius (foot per foot)	Minimum Tangent Distance Between Reverse Curves (feet)
THOROUGHFARE SYSTEM				
Principal Arterial	SHALL MEET NCDOT ROADWAY STANDARDS & SPECIFICATIONS			
Secondary Arterial	50	849	0.06	400
Major Thoroughfare	50	849	0.06	350
Minor Thoroughfare	40	573	0.04	250
COLLECTOR STREET SYSTEM				
Collector Street	35	395	0.04	200
Residential Collector	30	300	N/A ¹	0 ¹
LOCAL STREET SYSTEM				
Commercial Street	35	395	0.04	200
Residential Street	25	275	N/A ²	0 ²
Minor Residential Street	25	150	N/A	0
Marginal Access Street	25	150	N/A	0
PRIVATE STREET SYSTEM				
Main Circulation Routes		75	N/A	0
All Other Streets		50	N/A	0

Notes:

1. Center line radius may be reduced to 230 feet if roadway is superelevated at a maximum rate of 0.04 foot per foot and tangent distance between reverse curves of at least 125 feet is provided.
2. Center line radius may be reduced to 150 feet if roadway is superelevated at a maximum rate of 0.04 foot per foot and tangent distance between reverse curves of at least 100 feet is provided.

Table 5. Vertical Curve Design Criteria

Street Classification	Design Speed (mph)	Maximum Gradient ¹ (%)	Minimum Vertical Curve Length ² (feet)	Minimum Rate of Vertical Curvature, K (length in feet per % of A ³)	
				Crest	Sag
THOROUGHFARE SYSTEM					
Principal Arterial	SHALL MEET NCDOT ROADWAY STANDARDS & SPECIFICATIONS				
Secondary Arterial	50	7	150	160	110
Major Thoroughfare	50	7	150	160	110
Minor Thoroughfare	40	8	125	80	70
COLLECTOR STREET SYSTEM					
Collector Street	35	9	110	50	50
Residential Collector	30	9	110	28	28
LOCAL STREET SYSTEM					
Commercial Street	35	9	110	50	50
Residential Street	25	12	50	18	18
Minor Residential Street	25	12	50	18	18
Marginal Access Street	25	12	50	18	18
PRIVATE STREET SYSTEM					
Main Circulation		15	50	18	18
All Other Streets		15	50	18	18

Notes:

1. The minimum gradient on streets shall be at least 0.75%.
2. All vertical curves must be symmetrical parabolic curves.
3. A = the algebraic difference in vertical curve grades.

4.5 INTERSECTION DESIGN

Angles

Streets should intersect at or as near ninety (90) degrees as possible, but no less than seventy-five (75) degrees.

Spacing

Intersections of roadways controlled by a traffic signal should be spaced along roadways at the following minimum intervals:

Principal Arterials	1/2 - 1 mile
Secondary Arterials.....	1/4 mile
Major / Minor Thoroughfares	1/4 mile
Other Streets.....	660 feet

Four-legged intersections not controlled by a traffic signal should be spaced along roadways at the following minimum intervals:

Principal Arterials	1,000 feet
Secondary Arterials.....	500 feet
Major / Minor Thoroughfares	500 feet
Other Streets.....	200 feet

Three-legged intersections not controlled by a traffic signal should be spaced along roadways at the following minimum intervals:

Principal Arterials	500 feet
Secondary Arterials.....	400 feet
Major / Minor Thoroughfares	400 feet
Other Streets.....	150 feet

In general, if the left-turn lane storage requirements for adjacent intersections overlap, the minimum spacing shall be increased to provide adequate left-turn lane storage in both directions.

Median Cross-Over Spacing

Crossovers along median divided streets and highways should be spaced no closer than the following intervals.

Principal Arterials	1/4 - 1/2 mile
Secondary Arterials.....	1/4 mile
Other Streets.....	660 feet

In general, if the left-turn lane storage requirements for adjacent intersections overlap, the minimum spacing shall be increased to provide adequate left-turn lane storage in both directions.

Corner Radii

The following vehicle types should be used to design back of curb radii or other elements of design at intersections of roadways:

<u>Roadway Classification</u>	<u>Design Vehicle Type</u>
All Residential Streets.....	Passenger Vehicle (P)
Marginal Access Streets.....	Single-Unit Truck (SU)
Commercial Streets.....	Intermediate TTST (WB-40)
Collector Streets.....	Intermediate TTST (WB-40)
Thoroughfare System Roadways.....	Large TTST (WB-50)

TTST = Combination Tractor-Truck / Semi-Trailer

At roadway intersections, property line corners shall be rounded with a radius of at least twenty (20) feet. This radius shall be increased if the back of curb radii is larger than thirty (30) feet.

4.6 SIGHT DISTANCE

Sight distance is the length of roadway ahead visible to the driver. The minimum sight distance available on the roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.

The method of measuring stopping sight distance along a roadway is illustrated in Figure 8. Minimum stopping sight distances, as shown in Table 6, shall be provided in both the horizontal and vertical planes for planned roadways as related to assumed driver's eye height and position. Where there are sight obstructions (such as walls, cut slopes, buildings and other hazards) on the inside of curves, changes in roadway alignment may be required to obtain adequate stopping sight distance if the sight obstruction can not be removed.

Table 6. Stopping Sight Distance

Operating Speed	Minimum Stopping Sight Distance (in feet)						
	Street Grade in Percent						
	Upgrades			Flat	Downgrades		
	9%	6%	3%	0%	-3%	-6%	-9%
25 mph	140	145	150	150	155	160	165
30 mph	180	190	200	200	210	220	230
35 mph	225	235	245	250	265	280	300
40 mph	295	305	315	325	345	365	395
45 mph		375	385	400	425	455	
50 mph		445	455	475	505	545	

Note: See Figure 8 for illustration of sight distance measurements

Source: A Policy on Geometric Design for Highways and Streets, American Association of State Highway and Transportation Officials, 1990.

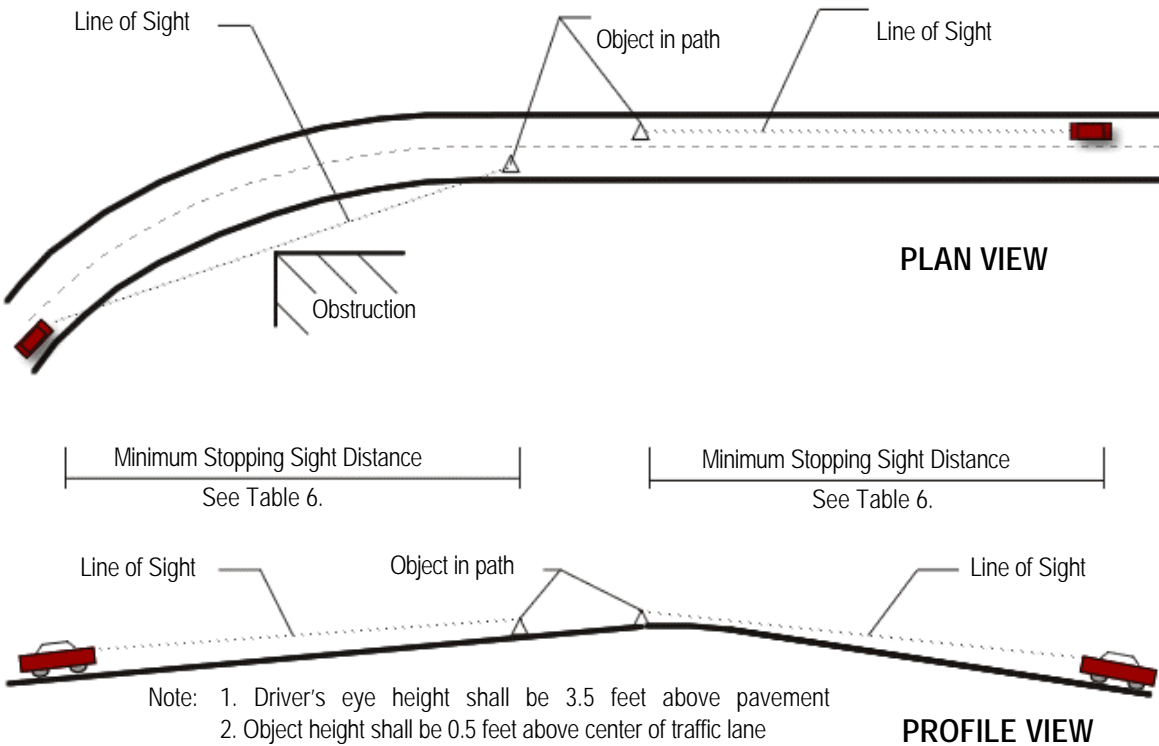


Figure 8. Stopping Sight Distance

4.7 INTERSECTION SIGHT DISTANCE

Intersections should be planned and located to provide as much sight distance as possible. A basic requirement for all controlled intersections is that drivers must be able to see the control device well in advance of performing the required action. Stopping sight distance on all approaches is needed as a minimum. Obstruction-free sight triangles shall be provided in both the horizontal and vertical planes, as related to assumed driver's eye height and position.

At any intersection of two roadways, a sight triangle, as illustrated in Figure 9, shall be provided for an unobstructed path of sight. The sight distance triangle can be defined by connecting a point that is along the minor street's edge of pavement and fifteen (15) feet from the edge of pavement of the major street, with a point that is distance (L) along the major street's edge of pavement.

Table 7 summarizes the required sight distance (L) along the major road for a stopped vehicle on the minor road to cross the major road. If a roadway is divided with a median width of twenty (20) feet or more for passenger vehicle crossings, or forty (40) feet or more for truck crossings, the required sight distance may be based on a two-stop crossing and consideration given to the width of each one-way pavement at a time.

Within the area of above defined sight triangle, there shall be no sight obstructing or partly obstructing wall, fence, sign, foliage, berming or parked vehicles between the heights of twenty-four (24) inches and eight (8) feet above the curb line elevation or the nearest traveled way if no curbing exists.

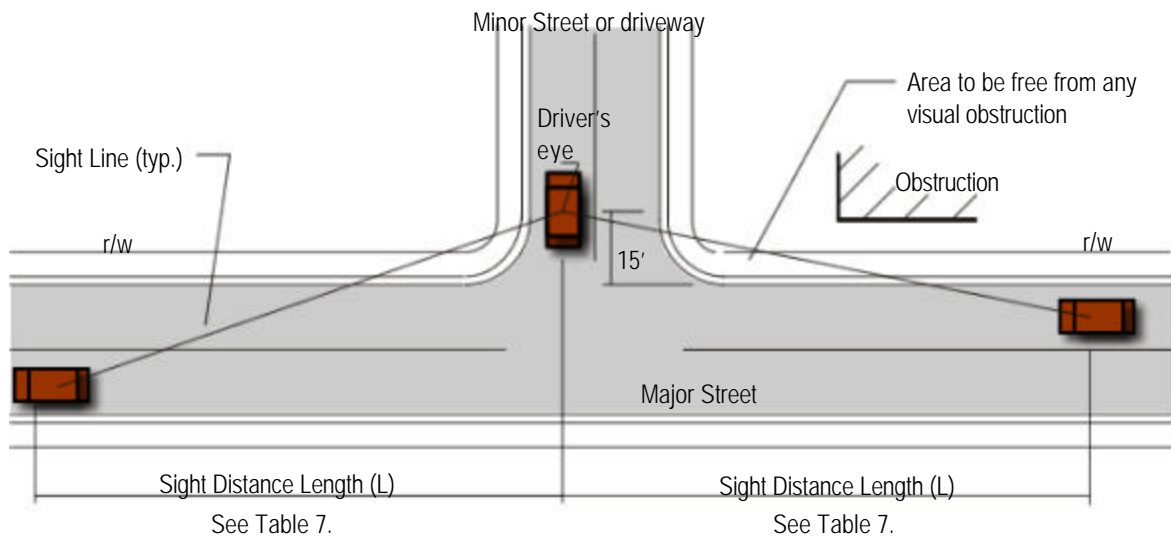
Objects which may be located in the sight triangle are items such as; hydrants, utility poles, utility junction boxes, and traffic control devices provided these objects are located to minimize visual obstruction.

Table 7. Intersection Stopping Sight Distance

Vehicle	Minimum Stopping Sight Distance, L (in feet) per 10 mph of Operating Speed Major Street Width of:			
	2-Lanes	4-lanes	6-lanes	8-lanes
Passenger Vehicle (P)	100	120	130	140
Single-Unit Truck (SU)	130	150	170	190
Large TTST (WB-50)	170	200	210	220

Note: This table summarizes the required sight distance along major streets for a stopped vehicle to cross the major street. If located on a divided facility, the median width is not accounted for in this table. Where the median width is 20 feet or more for passenger vehicle crossings, or 40 feet or more for truck crossings, the required sight distance may be based on a two-stop crossing and consideration given to the width of each one-way pavement at a time. See Figure 9 for illustration of sight distance measurements.

Source: A Policy on Geometric Design for Highways and Streets, American Association of State Highway and Transportation Officials, 1990.



- Note**
1. Driver's eye height shall be 3.5 feet above the pavement for passenger vehicles and 6.00 feet above the pavement for trucks
 2. Driver's eye shall be placed 15' from the edge of pavement.
 3. Object height (approaching vehicle) shall be 4.25 feet above the center of traffic lane

Figure 9. Intersection Sight Distance

4.8 STREET WIDTH TRANSITION TAPERS

When constructing a street that will directly connect with an existing street of different width, it is necessary to install a transition taper between the two.

The length of taper depends upon the offset differences between the outside traveled edge of the two sections and the design speed of the roadway. Formulas for determining transition taper lengths are shown below:

$$\text{For Speeds} \leq 40 \text{ mph:} \quad L = \frac{W * S^2}{60}$$

$$\text{For Speeds} > 40 \text{ mph:} \quad L = W * S$$

where,

- L = transition taper length, feet
- W = width of pavement offset, feet
- S = roadway design speed, mph

When tapers are located on a curve, the separate halves of the roadway should be designed with different curves to create the taper without any angle points in the curvature.

4.9 TURNING LANES

It may be necessary to construct turning lanes for right and left turns into a driveway or street for safety and capacity reasons or where roadway speeds and traffic volumes are high or if there are substantial turning volumes. The purpose of a separate turning lane is to expedite the movement of through traffic, increase roadway capacity, permit the controlled movement of turning traffic, and promote the safety of all traffic. Design elements which make up a turning lane are shown in Figure 10.

Turning Lanes

Turn lanes should be twelve (12) feet in width; however, the lane width may be reduced to be compatible with the adjacent roadway lane width. In no event shall the turn lane width be less than ten (10) feet

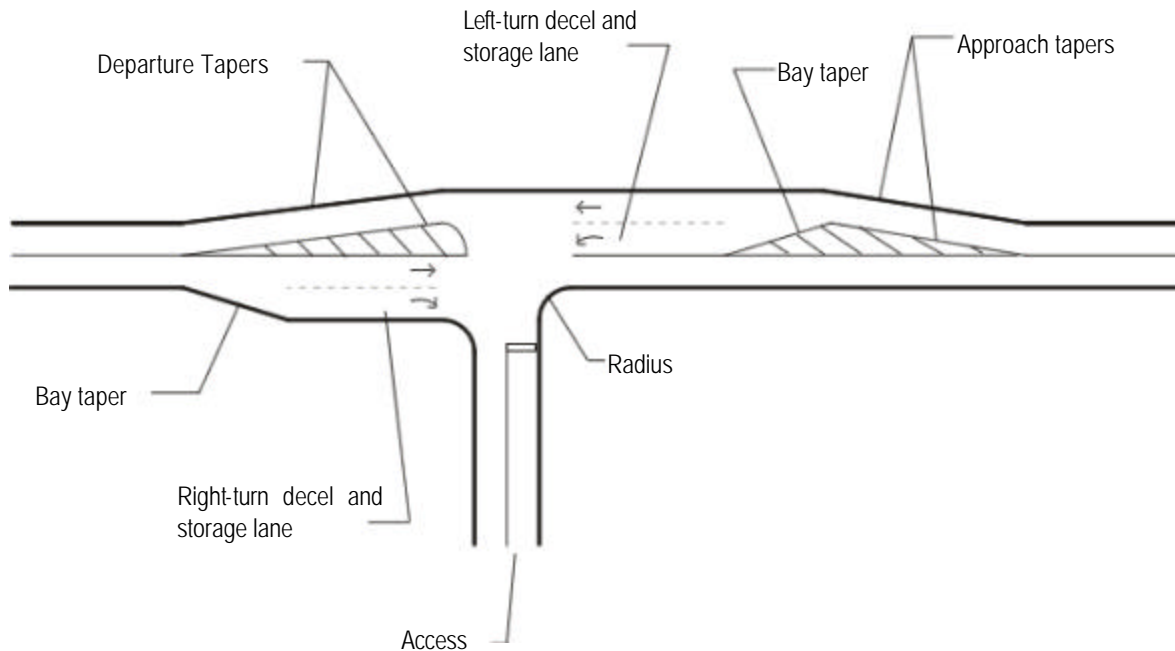


Figure 10. Turn Lane Design Elements

Total Length of Turn Lane

A separate turning-lane consists of a taper plus a full width turn lane. The design of the lane is based primarily on the speed at which drivers will turn into the lane, the speed to which drivers must reduce in order to turn into the driveway or side street after traversing the deceleration lane, and the amount of vehicular storage that will be required.

The total length of the turning lane and taper should be determined by either: (1) the combination of turn lane or through lane queue storage plus the bay taper, or (2) right-turn / deceleration requirements, whichever is the greatest.

(1a) Turn Lane Storage -- Signalized Intersections

Where traffic is to be controlled by a traffic signal, the turn lane should be of sufficient length to store the turning vehicles and clear the equivalent lane volume of all other traffic on the approach, whichever is the longest. This length is necessary to ensure that full use of the separate turn lane will be achieved and that the queue of the other vehicles on the approach will not block vehicles from the turn lane.

The storage requirements for turn lanes should be based upon the peak 15-min. flow rates of turning traffic. The average number of turns per cycle can then be multiplied by a factor to account for random variations in arrivals. The length of turn lane can be estimated by the following formula:

$$L = \frac{V * K * 25 * (1 + p)}{N}$$

where,

- L = storage length of turn lane, feet
- V = peak 15-minute flow rate of turning volume, vph
- K = constant to reflect random arrivals
 - K = 2.0 for 95% probability of storing all vehicles
 - K = 1.5 for 90% probability of storing all vehicles
- 25 = approximate length of vehicle, feet per vehicle
- p = percent of trucks or buses (use 5% if unknown)
- N = number of cycles per hour

The storage requirement for a separate turn lane is also based on the amount of queue length necessary to accommodate other vehicles arriving on the approach during the red phase of the cycle. The “red time” formula for estimating the storage length for other vehicles is as follows:

$$L = \frac{V * K * 25 * (1 - \frac{g}{C})}{(N * I)}$$

where,

- L = storage length of turn lane, feet
- V = peak 15-min. flow rate approaching vehicles, vph
- K = constant to reflect random arrivals
 - K = 2 for 95% probability of storing all vehicles
 - K = 1.5 for 90% probability of storing all vehicles
- 25 = approximate length of vehicle, feet per vehicle
- g = green time, seconds
- C = cycle length, seconds
- N = number of cycles per hour
- I = number of approaching vehicle lanes

(1b) Turn Lane Storage -- Unsignalized Intersections

The storage length for turning vehicles at intersections not controlled by a traffic signal should be determined by using the formulas for signalized intersections as outlined above. Storage requirements should be based on an assumed minimum cycle length of 90-seconds.

(2) Right-Turn / Deceleration Lengths

The lengths required to come to a stop from either the design speed or an average running speed of a roadway, are indicated in Table 8. The lengths assume the roadway is on a two percent (2%) or less vertical grade. The desirable deceleration lengths should be used on new roadways and the minimum may be used along existing roadways. Longer deceleration lengths may be required on downgrades greater than two percent (2%).

Table 8. Right-Turn / Deceleration Lengths

Design Speed (mph)	Right-turn / Deceleration Length (feet)	
	Desirable ¹	Minimum ²
30	235	185
35	270	240
40	315	295
45	375	350
50	435	405
55	480	450

Notes:

1. Assumes stop condition
2. Assumes 15 mph speed differential

Source: A Policy on Geometric Design for Highways and Street, American Association of State Highway and Transportation Officials, 1990.

Tapers

Approach, departure and bay taper lengths for separate turn lanes should be based on the following formulas:

$$\begin{array}{ll} \text{Approach \& Departure Taper} & L = \frac{W * S^2}{60} \\ \text{for speeds } \leq 40 \text{ mph} & \end{array}$$

$$\begin{array}{ll} \text{Approach \& Departure Taper} & L = W * S \\ \text{for speeds } > 40 \text{ mph} & \end{array}$$

$$\begin{array}{ll} \text{Bay Taper} & L = \frac{W * S}{3} \end{array}$$

where,

L = taper length, feet
W = width of offset, feet
S = design speed, mph

4.10 PAVEMENT MARKINGS

When a development is required to improve roadways, the developer shall be required to install pavement markings on the surface of thoroughfare or collector street system roadways. Other roadways will be considered on a case-by-case basis. Pavement marking plans and installation should be in conformance with NCDOT standards and specifications.

4.11 PRIVATE STREET DESIGN

Easement Width

All private streets shall be located within an easement area with a minimum width equal to the pavement width plus two and one-half feet on each side with the area being located outside of any lot dimension used to satisfy lot size requirements.

Street Width

Private streets shall be a minimum width of twenty-five (25) feet for two-way streets, sixteen (16) feet in width for one-way streets. Private streets serving sixteen (16) or fewer dwelling units may be reduced to eighteen (18) feet in width for two-way streets and ten (10) feet for one-way street, if five (5) feet all-weather, stabilized shoulder, are provided on each side. Figure 11 illustrates typical design cross sections for private streets. The street width may be increased at the discretion of the City, if required to mitigate safety problems or expected increases in traffic congestion.

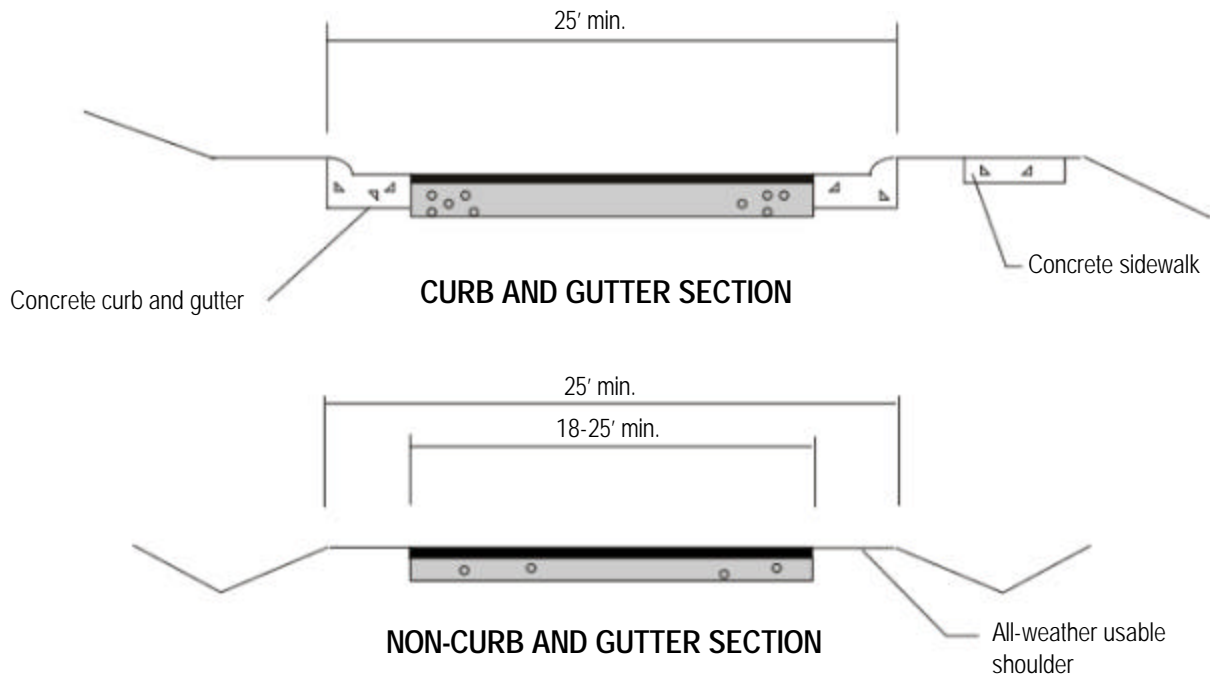
Sidewalk

General pedestrian access within a development shall be provided and shall connect buildings with public or private sidewalks, public streets, greenway access points, and adjoining activity centers such as schools and shopping centers as defined in the City Code. Each block, or each building in the case of group housing or multi-family developments, should be served by a connection to the pedestrian access system.

Street Alignment

The minimum horizontal and vertical street design standards for private streets are shown in Tables 4 and 5, respectively. The network of private streets shall be designed to accommodate turning movements of garbage trucks, moving vans, emergency and other service vehicles.

Figure 11. Private Streets



Traffic Flow

It shall be the responsibility of the property owner(s) or homeowners' association to establish speed limits and maintain uninterrupted traffic flow along all private streets within a project. If it is necessary for "no parking" signs to be erected, for street lights to be installed, or towing of vehicles to be undertaken in order to accomplish this, then it is to be done at the expense of the property owner(s) or the homeowners' association.

Street Signage

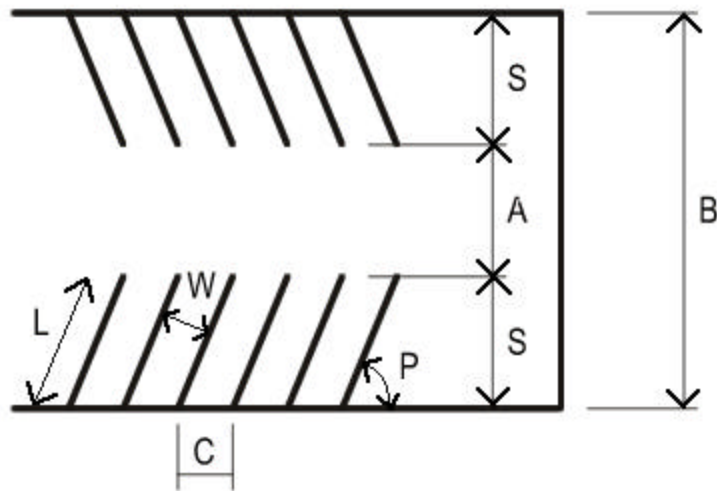
All private streets and drives shall contain identification in conformance with City standards.

Parking Lots

Parking lots should be designed to provide for safe pedestrian and vehicular circulation. Pedestrian flow should provide for as few conflicts with vehicle traffic as possible. Required parking spaces shall be arranged and sized in accordance with the regular and compact parking space design schedules shown in Figure 12. Stall depths and module widths shall be measured to the face of curb or to the edge of pavement if curbing is not used.

Handicap parking spaces shall be designed and delineated in accordance with the standards outlined in the publication titled, "*North Carolina Building Code, Volume I-C.*"

Parking lots should also be signed and maintained with appropriate traffic control devices and pavement markings so as to regulate the safe movement of vehicles and pedestrians within the parking area.



P=Parking Angle, degrees
C=Curb Width, feet
S=Stall Depth, feet

W=Stall Width, feet
A=Aisle Width, feet
B=Module Width, feet

Regular Space Parking Area Design

Parking Angle (P)	Curb Width (C)	Stall Depth (S)	Stall Width (W)	Aisle Width (A)	Module Width (B)
90	8.5	18.0	8.5	24.0	60.0
75	8.8	19.6	8.5	23.0	62.2
60	9.8	19.8	8.5	14.5	54.1
45	12.0	18.7	8.5	12.0	49.4
30	17.0	16.4	8.5	12.0	44.8
0	22.0	8.0	8.5	12.0	28.0

Length of stall, $L=18$ feet

Compact Space Parking Area Design

Parking Angle (P)	Curb Width (C)	Stall Depth (S)	Stall Width (W)	Aisle Width (A)	Module Width (B)
90	7.5	15.0	7.5	24.0	54.0
75	7.8	16.5	7.5	23.0	56.0
60	8.7	16.8	7.5	14.5	48.1
45	10.6	15.9	7.5	12.0	43.8
30	15.0	14.0	7.5	12.0	40.0
0	19.0	7.5	7.5	12.0	27.0

Length of stall, $L=15$ feet

Figure 12. Parking Area Design

Modifications to Figure 12 may be made in accordance with the following:

- 1) A reduction in aisle width in parking decks and other structures if there is a compensating increase in the stall width.
- 2) Reductions in aisle width, the utilization of stacked parking stalls, or other changes to access or dimension of parking areas if parking is performed on a continuing basis by paid employee attendants.
- 3) Allowance of stacked parking stalls, where each stall does not have access to an aisle or street, if the parking area is specifically designed and designated in the field to serve a particular dwelling unit in a planned development. The parking stall may be located in a garage, carport, or other enclosed space.

4.12 GUIDELINES FOR DRIVEWAY ACCESS POINTS ALONG THOROUGHFARE SYSTEM ROADWAYS

Number of Driveway Access Points

All lots, parcels, or any other division of land of four hundred (400) linear feet or less adjacent to a thoroughfare system roadway should have no more than one (1) driveway access point connected to the thoroughfare system roadway. All lots greater than four hundred (400) linear feet adjacent to a thoroughfare system roadway should have no more than one (1) driveway access point onto the thoroughfare system roadway for each four hundred (400) linear feet adjacent to the thoroughfare system roadway. For instance, a lot with six hundred (600) linear feet adjacent to a thoroughfare system roadway should be permitted no more than one (1) driveway access point, while a lot with nine hundred (900) linear feet adjacent to a thoroughfare system roadway should be permitted no more than two (2) driveway access points.

Location of Commercial Driveway Access Points

Location guidelines for driveway access points along thoroughfare system roadways are illustrated in Figure 13. If access to a lot, parcel, or any other lawful division of land is physically unobtainable under the provisions illustrated in Figure 13, driveway access points are to be located the greatest distance possible from one another and from other public and private streets.

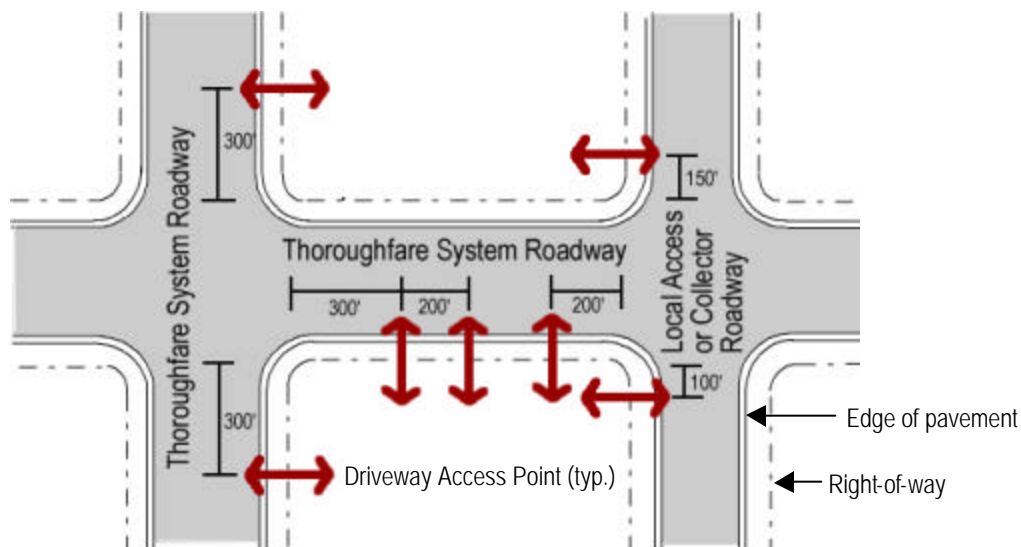


Figure 13. Driveway Access Spacing Guidelines

4.13 GUIDELINES FOR MIXED-USE CENTERS

Mixed Use Centers as described in the Urban Design Guidelines approved by City Council on April 16, 2002, as may be amended, shall comply with all the following guidelines and roadway design cross-sections that are in addition to the other requirements in the Handbook. Where a conflict in requirements exists, the stricter shall control. These guidelines shall apply to all streets within and bounding a Mixed-Use Center.

Street Design Operating Speed

The intent is to post internal local access roadways not designated a thoroughfare or collector roadway for twenty-five (25) mph operating speed.

Street Interconnection

Streets should interconnect within a development and with adjoining development. Cul-de-sacs or dead-end streets are generally discouraged except where topographic environmental conditions and/or adjoining development patterns offer no practical alternatives for connection or through traffic. Street stubs shall be provided with development adjacent to open land to provide for future connections.

Private or gated streets are strongly discouraged within Mixed-Use Centers.

Within a Mixed-Use Center, an interconnected pattern of public connective streets shall be established, such that no *street block face* shall exceed six hundred sixty (660) feet in length.

Each side of a public collector, commercial, residential collector, residential or minor residential street within a Mixed-Use Center shall be intersected by at least one connective street within every six hundred sixty (660) -foot length of the street. The six hundred sixty (660) -foot length shall be measured from the centerline of the intersecting streets. If an intersection is located that interrupts a dominant traffic flow along two or more streets, then both streets are included in the calculation of the six hundred sixty (660) -foot length.

Streets shall be interconnected so that any area within the Mixed-Use Center completely enclosed by public streets does not exceed ten (10) acres.

A development may be approved which contains a street(s) in excess of six hundred sixty-foot length (without an intersection on each side with a connective street or enclosing more than ten (10) acres) if:

- 1) The existing adjoining and surrounding development prevents extending a street, or severe topography or other physical features warrant a longer street length, and this alternative location, whether inside or outside the development, is provided for at the time the development making the request is approved; or,
- 2) The existing street pattern provides equivalent benefits as a six hundred sixty-foot block length in terms of traffic dispersal, and pedestrian access to uses within and outside the mixed-use center.

Driveways and Cross-Access

Each property containing or designated for nonresidential, apartment house, or group housing uses should provide at least one vehicular access to each abutting property. This is most often accomplished by joining adjacent parking lots and sharing driveways. Development plans should provide a cross-access easement and complete the connection if an immediate benefit can be derived by completing the link. If no immediate benefit can be derived, development plans should provide cross access and construction easements and arrange the site design so when the adjoining property owner extends the connection to the property line, the link will be completed. If the link is to be completed in the future, the grade of the connection, parking, landscaping and other improvements must be set to allow for extension into the adjacent lot.

Whenever possible, internal access drives should be located to join together existing public streets and/or connect to adjacent private drives so that the internal circulation functions as an integral part of the surrounding transportation network.

Developments should minimize or eliminate curb cuts along adjacent streets. Where possible, vehicular access should be shared with the adjacent properties and/or alleys should be utilized for access.

Private Alleys

Alleys should be utilized for access to parking, service and loading areas to minimize the number of driveways along the main pedestrian spaces. A mechanism shall be established for maintenance of all private alleys, which may include creation of a homeowner's association. Alleys may also be utilized for utilities to protect landscaping.

Transit

To facilitate transit usage and circulation, Mixed-Use Centers should provide transit stops at key nodes with easy access to the surrounding thoroughfares. Transit routes through the mixed-use center shall be designed to accommodate the technical requirements of bus operations. Transit easements through and within mixed use centers shall be provided as requested by the Transportation Director.

A coherent and easily maneuverable path through the Mixed-Use Center should be designed to permit transit to move freely and efficiently throughout the mixed-use center.

On-Street Parking

On-street parking provided should be parallel. On-street parking other than parallel shall be angle parking, and shall only be permitted on local access streets within the Mixed-Use Development.

Where on-street parking is provided, the landscape strip should be planted in grass at-grade. This will enable people to walk directly from their car to the sidewalk. Shrubs, ground covers, trees and raised planters should be located so as not to conflict with opening car doors or pedestrians' access to and from on-street parking.

Pedestrian Facilities and Street Treatments

Local access streets may incorporate traffic calming devices. Streets should be designed so pedestrians have convenient and safe means to cross streets. Allowable treatments may include but not be limited to roundabouts, raised pedestrian crosswalks, multi-way stops, bulb-outs, alternative pavement treatments, and signals at crosswalks when warranted.

No street shall contain more than three traffic lanes unless a median a minimum of eight feet wide (after all potential road widening is complete) is provided that is designed for pedestrian usage.

Pedestrian circulation adjoining streets is illustrated in Figures 14a thru 14d. These diagrams are of pedestrian berms, which constitute the improvements to the portion of public street right-of-way outside the vehicular travel lanes. The type of pedestrian berm required is determined by the predominant use that is oriented toward the block face, and other variables noted below. The Core Area and Transition Area are described in the **Urban Design Guidelines**. Regardless of the specific adjacent uses, the berms chosen shall provide a uniform system (and not vary back-and-forth) among adjoining street block faces, with the widest pedestrian ways located in the Core Area.

Trees will be planted so as not to impede street lighting or sight distance requirements at intersections. Street trees located in the public right-of-way shall have adequate planting areas as determined by the City.

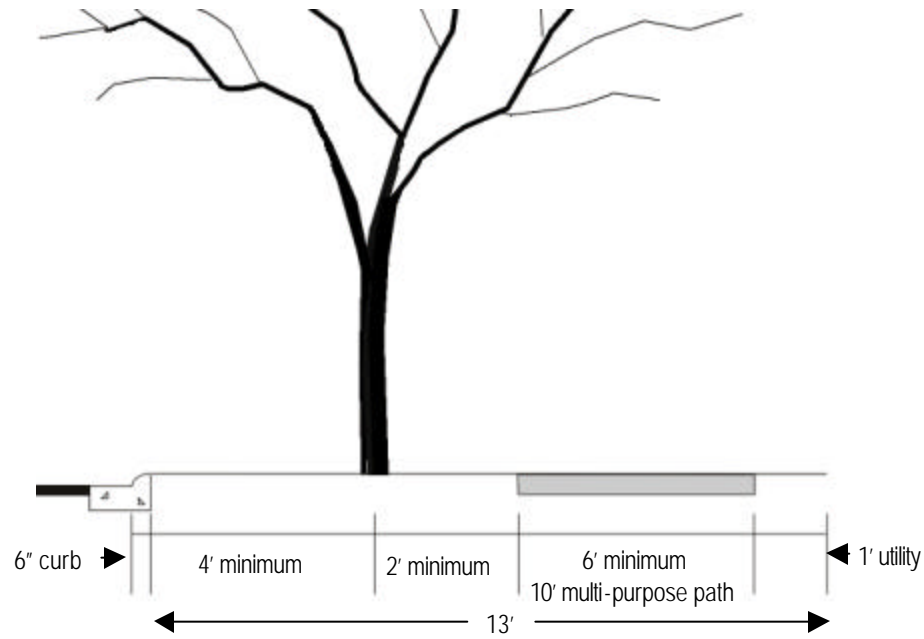


Figure 14a. Transition Pedestrian Way (Transition Area)

Appropriate for low-to-medium density residential and related uses. Parallel parking is generally permitted along the street. A continuous planting strip is provided, at least six feet wide, with eight feet preferred for larger trees.

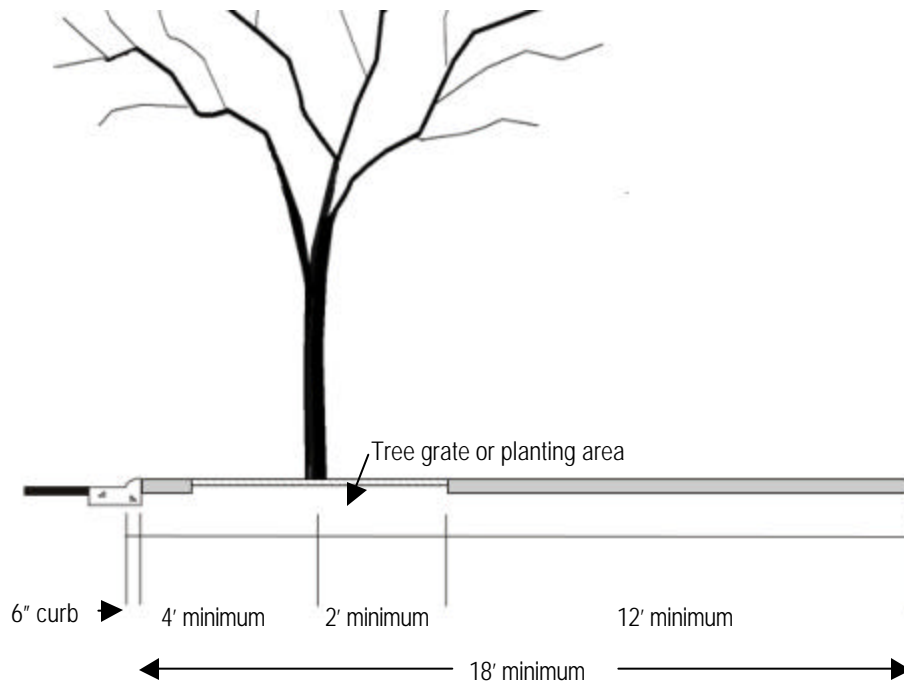


Figure 14b. Secondary Pedestrian Way (Core / Transition Areas)

Appropriate where the predominate use is office, institutional and civic uses, and high density residential, but minimal storefront/retail uses adjoining right-of-way. Parallel parking generally permitted on the street.

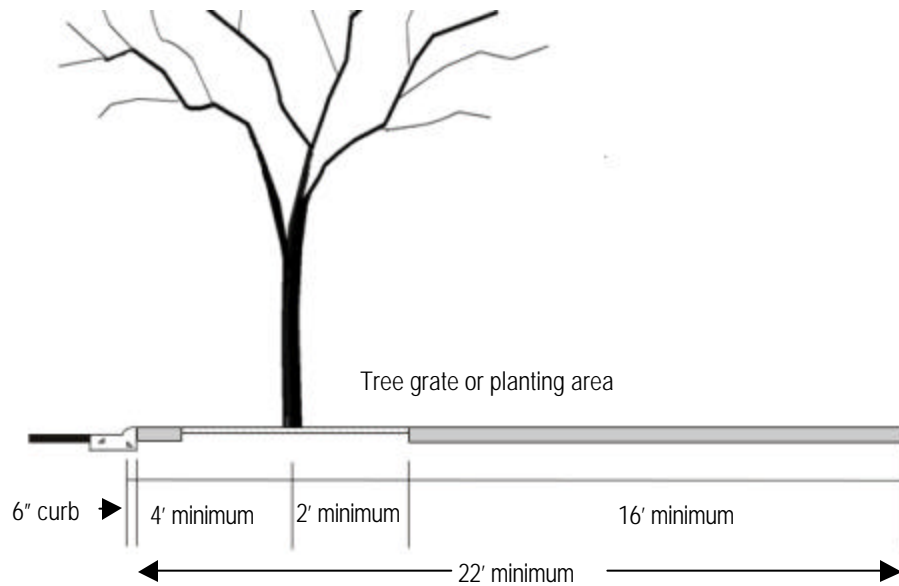


Figure 14c. Primary Pedestrian Way (Core Area)

Appropriate where the street block face is predominantly made up of first-floor retail establishments, restaurants, outdoor seating and/or vendors, entertainment/recreation uses, or other commercial structures. Parallel parking is generally permitted on the street..

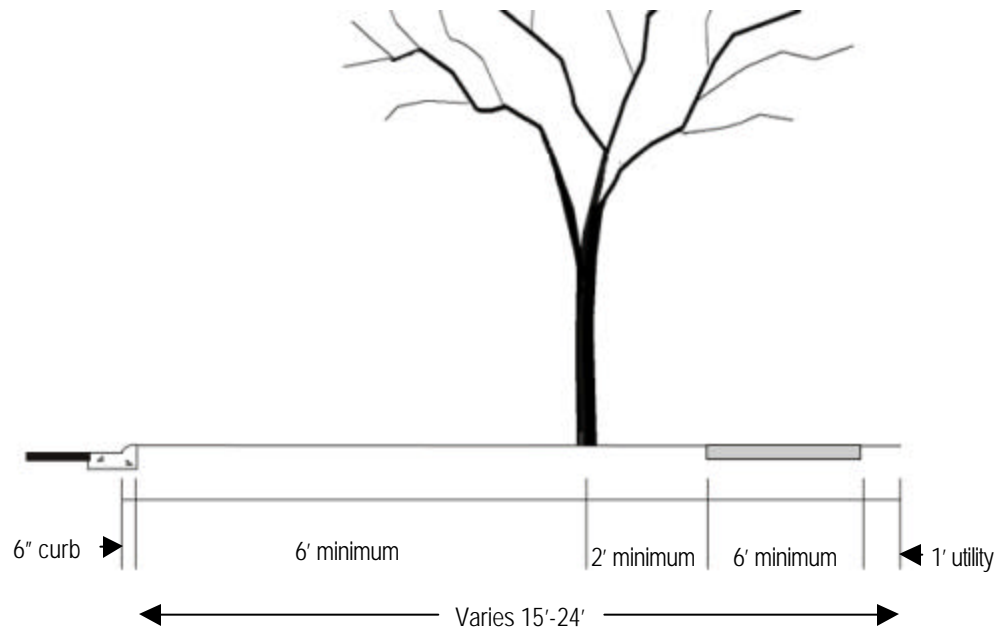


Figure 14d. Frontage on a Thoroughfare / Arterial

Where a thoroughfare/arterial bounds a Mixed-Use Center, or divides a Mixed-Use Center into parts, a berm with a 6' wide sidewalk should be installed. Core mixed-use buildings should be oriented toward other streets. However, if core building orientation occurs toward the thoroughfare/arterial, the thoroughfare/arterial shall be improved to include a median of at least eight feet in width for the safety/convenience of pedestrians. In addition, the Secondary or Primary Pedestrian Way sidewalk widths should apply, with a continual planting strip of 8' minimum width. If the adjoining property is within a Resource Management District, the Street Yards for that District shall apply, and the property owner shall have no additional responsibility for street trees on the public right-of-way..

GLOSSARY OF TERMS

AASHTO: American Association of State Highway and Transportation Officials.

APPROACH: The portion of an intersection leg which is used by traffic approaching the intersection.

AVERAGE DAILY TRAFFIC (ADT): The total bi-directional volume of traffic passing through a given point during a given time period (in whole days), divided by the number of days in that time period.

CAPACITY: The maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform segment of a lane or roadway during a given time period under prevailing traffic, roadway and control conditions.

CAPITAL AREA THOROUGHFARE PLAN: A roadway plan adopted by the Capital Area Metropolitan Planning Organization which illustrates the location and classification of all thoroughfare system roadways in the greater Raleigh urban area.

CITY: The City of Raleigh, North Carolina.

CITY CODE: The Charter and Code of Ordinances of the City of Raleigh, North Carolina.

CITY COUNCIL: The governing body for the City of Raleigh, North Carolina.

CITY STANDARDS & SPECIFICATIONS: Those standards prescribed for the construction of streets, sidewalks, driveway access points, curb and gutter set out in this manual and the City Code.

COMMERCIAL DRIVEWAY ACCESS: Any driveway access point that does not meet the definition of residential driveway access.

COMPREHENSIVE PLAN: The “Raleigh Comprehensive Plan” was adopted by the City Council as a guide for the development of the City and territory surrounding the City, consisting of maps, charts and text.

CONNECTIVE STREET: A street within a development, other than a cul-de-sac street or loop street, which will allow vehicular and pedestrian circulation to adjoining developments; thereby providing for community-wide circulation.

CORNER CLEARANCE: At an intersecting street, the distance measured from the edge of pavement curb line or the intersection of right-of-way lines to the beginning of outside driveway radius.

DEAD-END STREET: A local access system street opened at one end only with special provisions for a vehicle to turn around.

DESIGN SPEED: Usually up to five miles per hour above the expected operating speed of the facility under design.

DEVELOPER: A site planner or subdivider.

DEVELOPMENT OR DEVELOPMENT PLAN: Any site plan or subdivision.

DRIVEWAY ACCESS POINT: A point of ingress and egress, or both, which is considered a private driveway. It can be either a residential access point or a commercial driveway access point.

DRIVEWAY WIDTH: The narrowest width of driveway measured parallel with the edge of street.

LOOP STREET: A street which is designed to discourage through traffic from other areas and both ends of the loop street connect with the same intersecting street.

MEDIAN: That portion of a divided roadway separating the traveled ways for traffic in opposite directions.

NCDOT: The North Carolina Department of Transportation.

PAVEMENT MARKINGS: All lines, words or symbols, except signs officially placed within the roadway or parking area to regulate, warn or guide traffic.

PEAK-HOUR VOLUME: Hourly traffic volume used for roadway design and capacity analysis, usually occurring during one or more peak travel hours during a 24 hour period.

RESIDENTIAL DRIVEWAY ACCESS: A driveway access point serving a single family dwelling, mobile home, detached townhouse, two attached townhouses, duplex, multi-unit supportive housing residence, supportive housing residence which is required to provide no more than two (2) off-street parking spaces, or a driveway serving a nonresidential use if the daily volume of two-way driveway traffic is expected to be less than fifty (50) vehicles.

RIGHT-OF-WAY: An interest in land to the City which provides for the perpetual right and privilege of the City and its agents, franchise holders, successors, and assigns to construct, install, improve, repair, maintain, and use a public street, including related and customary uses of street rights-of-way such as sidewalk, bike path, landscaping, traffic control devices and signage, sanitary sewer, stormwater drainage devices, water supply, cable television, electric power, gas, and telephone transmission and related purposes in, upon, over, below, and across the rights-of-way. The City is authorized to remove, and keep removed from the rights-of-way all trees, vegetation, and other obstructions as is determined to be necessary by the City to maintain, repair, and protect facilities located in the right-of-way

RIGHT-OF-WAY CENTER LINE:

- (1) The right-of-way centerline of a two-way street shall be a point equidistant between the inside edges of the innermost through travel lane in each direction of travel.
- (2) The right-of-way centerline of a one-way street shall be a point equidistant between the outside edges of the outermost through travel lanes in the direction of travel.
- (3) Where the alignment of an existing street is to be altered or changed, the right-of-way centerline shall be determined in accordance with the new realignment plan, provided the City and/or NCDOT have approved the plan.
- (4) In special cases where non-symmetrical street widening has occurred or other unique situations not covered by the above exist, the right-of-way centerline shall be defined by the Transportation Director.

ROADWAY: See definition of street.

SIDEWALK: Any public or private pedestrian or bicycle walkway or path.

SLOPE EASEMENT: An easement, which is reasonably necessary and incidental to the construction within the adjoining right-of-way of public street or sidewalk, or both, by the City, state, or their contractors. The purposes to which the easement area may be used include cutting, sloping, filling, installation of stormwater drain pipes or other drainage facilities, grading or otherwise changing the natural contour of the easement area in order to support and to accommodate the development of the adjacent street right-of-way, in accord with generally accepted engineering practices. Following the construction of the adjacent street or sidewalk, or both, the area subject to this easement will

be graded, stabilized, and restored using conventional engineering and landscaping methods. Thereafter, the landowners with the underlying fee interest may make and enjoy all lawful uses of the property subject to this easement, provided there be no damage to the lateral and subjacent support of the public street, sidewalk, or both or to any stormwater drainage facility.

STREET: A public or private roadway, but is not considered a driveway access point.

STREET BLOCK FACE: The physical characteristics of property and structures adjoining any one side of a street in-between intersections.

THROUGH STREET: A street, other than a dead-end street or loop street, that connects two perimeter property lines of a development.

TRAFFIC SIGN: A device mounted on a fixed or movable support, conveying a message or symbol to regulate, warn or guide traffic.

TRANSPORTATION DIRECTOR: The Department Head of the City of Raleigh Department of Transportation.

URBAN DESIGN GUIDELINES: A portion of the Guidelines section (Chapter 4) of the Raleigh Comprehensive Plan that describes the elements of Mixed-Use Neighborhood and Village Centers.

VOLUME: The number of vehicles passing a given point during a specified period of time.

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